REMARKS

Claims 53 through 104 remain in the application. Claims 105 through 113 are newly added.

The specification has been amended to add headings in accordance with U.S. practice, to correct a typographical error, and to correct awkward wording.

The claims have been amended to eliminate parentheses, to refer to elements in a consistent manner, to provide proper antecedent basis for elements, and to correct awkward wording.

As such, claims 53-104 have been clarified by amendment for purposes of form. It is respectfully submitted that the amendments to claims 53-104 are neither narrowing nor made for substantial reasons related to patentablity as defined by the Court of Appeals for the Federal Circuit (CAFC) in Festo Corporation v. Shoketsu Kinzoku Kogyo Kabushiki Co., Ltd., 95-1066 (Fed. Cir. 2000). Therefore, the amendments to claims 53-104 do not create prosecution history estoppel and, as such, the doctrine of equivalents is available for all of the elements of claims 53-104.

Claims 105-107 have been added to claim features previously claimed in the alternative in claim 55. Claim 108 has been added to claim features previously claimed in the alternative in claim 57. Claim 111 has been added to claim features previously claimed in the alternative in claim 63. Claims 112 and 113 have been added to claim values previously claimed as "preferable" in claim 83.

Consideration and allowance of all of the claims is respectfully requested.

Attached hereto is a marked up version of the changes made to the claims by the current amendment. The attached page is captioned "Version With Markings to Show Changes Made."

Respectfully submitted:

January 7, 2004
Date

Charles N. J. Ruggiero
Attorney for Applicants
Registration No. 28,468
Ohlandt, Greeley, Ruggiero &
Perle, L.L.P.
One Landmark Square, 10th Floor
Stamford, CT 06901-2682
(203) 327-4500

VERSION WITH MARKINGS TO SHOW CHANGES MADE

In The Specification

Please amend the specification as follows:

On page 1, between lines 2 and 3, insert -- 1. Field of the Invention --.

On page 1, between lines 4 and 5, insert --2. Discussion of the Background Art --.

On page 10, between lines 11 and 12, insert -- Summary of the Invention --.

On page 35, before line 1, insert -- Brief Description of the Drawings --.

On page 37, between lines 12 and 13, insert -- Detailed Description of the Invention --.

On page 39, replace the paragraph on lines 20-28 with the following:

> The gas, highly pressurized in the second compression stage 460, is pumped through the pipeline 504 into a storage cell 501, which is connected to a flange [501] 503. The storage cell can be closed at the valve 502 and disconnected from the polarizer (1) for transportation. These transportable cells 510 are also used for la long-term storage of polarized gas. An exemplary model used for medical applications of ^{3}He is therefore made of special Supremax glass (made by Schott Glas), which has a low iron content and a low Helium permeation rate. Within this glass vessel, ^{3}He relaxation times of up to 100 hours can be achieved. In addition, by means of a suitable inner coating of the cells, the relaxation times may be prolonged and storage times of up to 200 hours can be achieved.

On page 43, replace the paragraph on lines 29-30 with the following:

This principle - the interception of impurity gas entries by means of intermediate vacuum regions with movable vacuum lead in insulators - is hereinafter called "fractional pumping" [from now].

In the Claims

Please amend the claims as follows:

53[)]. (Amended) An ultra high vacuum (UHV) compatible lead-through, comprising:

a housing;

a first space within [said] the housing and connected via a first port to a space outside the UHV-compatible lead through;

a second space within [said] the housing and connected via a second port to a closed system containing a polarized gas;

a movable component separating the first space from the second space via an intermediate space; and

[seals] a seal for limiting a penetration of volatile media from [said] the first space into [said] the second space.

54[)]. (Amended) [Ultra] An ultra high vacuum [(UHV)] compatible lead through according to claim 53, [characterized in that said] wherein the intermediate space comprises a pumping connection.

55[)]. (Amended) [Ultra] An ultra high vacuum [(UHV)] compatible lead through according to claim 53, [characterized in that said] wherein the moveable component[s] within [said] the housing [are] is a piston[s] of a compressor[s or tappet rods of pistons or of valves].

56[)]. (Amended) [Ultra] An ultra high vacuum (UHV) compatible lead through according to claim [53] 105, further comprising a second adjunct tappet coupled to the first tappet rod with a certain free play of movement,

wherein the [characterized in that said] UHV compatible lead through serves as an outlet valve such that the outlet valve is [tightened] closed via [an adjunct tappet which is coupled with a certain free play of movement to a tappet according to claim 55] the second adjunct tappet, such that [in case of said] when the first tappet [being] rod is placed in an intermediate position, [said] the second adjunct tappet will [tighten said] open the outlet valve only by an overpressure on [the] an outlet side of the outlet [of said] valve[;] ,

[in case of said] wherein when the first tappet [being] rod is moved into [its] a forward position. [said] the second adjunct tappet will close [said] the outlet valve by force, independently of [the] pressure conditions[.] , and

[in case of said] wherein when the first tappet [being] rod is moved into [the] a rear position, [said] the second adjunct tappet will open [said] the outlet valve by force[,] independently of pressure conditions.

57[)]. (Amended) [Ultra] An ultra high vacuum [(UHV)] compatible lead through according to claim [53, characterized in that said] 55, wherein the intermediate space has a sufficient extension such that [the] a stroke of [said] the piston [or of said tappet of said device] is always shorter then the extension of [said] the intermediate space in [the] a direction of movement of the piston.

58[)]. (Amended) [Assembly of Ultra] An ultra high vacuum [(UHV)] compatible lead through according to claim 53, [characterized in that said assembly comprises several of said] further comprising a plurality of the moveable components, and a plurality of the intermediate spaces, wherein individual ones of the plurality of moveable components are each associated with an individual one of the plurality of intermediate spaces, an further wherein the individual ones of the plurality of movable components are placed next to each other in such a way that [said] the

individual ones of the plurality of intermediate spaces [which belong to said moveable components] are connected to each other in a conductive manner.

59[]]. (Amended) [Ultra] An ultra high vacuum [(UHV)] compatible lead through according to claim [53, characterized in that said] 55, wherein the intermediate space is sealed by gaskets fixed in notches around the [said] piston [or the said tappet or the surrounding cylinder].

60[]]. (Amended) [Ultra] An ultra high vacuum [(UHV)] compatible lead through according to claim 53, [characterized in that all of its] further comprising first parts which are in direct contact with the polarized [^{3}He comprise] gas, wherein the first parts include nonmagnetic or weakly magnetic materials having low outgassing rates.

61[]]. (Amended) [Ultra] An ultra high vacuum [(UHV)] compatible lead through according to claim 53, [characterized in that the components which are moved at/ or] further comprising second parts that are exposed to mechanical wear and tear, wherein the second parts include [comprise] little outgassing titanium or bronze.

62[]]. (Amended) [Ultra] An ultra high vacuum (UHV) compatible lead through according to claim 53, [characterized in that said] wherein the UHV-compatible lead through is a compressor, [designed in a way that the] the compressor has a cylinder head with a dead volume [in the cylinder head] that is minimized when [the] a piston of the compressor is in [the] a forward position.

63[]]. (Amended) [Ultra] An ultra high vacuum [(UHV)] compatible lead through according to claim 62, [characterized in that said] wherein the piston of [said] the compressor [or said tappet or said valve are] is driven by a hydraulic gear.

64[]]. (Amended) [Ultra] An ultra high vacuum [(UHV)] compatible lead through according to claim 63, [characterized in that said] wherein the hydraulic gear [of said piston comprises] includes two pressurized chambers inside of [said] the piston.

65[)]. (Amended) [Ultra] An ultra high vacuum [(UHV)] compatible lead through according to claim [63, characterized in that] 62, wherein the [gear] piston of [said] the compressor [comprises a fast running] is driven by a crankshaft with [conrod] a connecting rod.

66[)]. (Amended) [Device] A device for the production of nuclear spin polarized fluids

comprising:

an assembly for optical pumping a medium in a low pressure plasma[,] to produce a polarized medium;

a compressor assembly connected to the optical pumping assembly for compressing the polarized medium; and

a storage volume connected to the compressor assembly for storing the polarized medium,

wherein [said] the compressor assembly comprises at least one ultra high vacuum (UHV) compatible lead through [according to claim 53] , including:

a housing;

a first space within the housing and connected via a first port to a space outside the UHV-compatible lead through;

a second space within the housing and connected via a second port to the optical pumping assembly;

a movable component separating the first space from the second space via an intermediate space; and

a seal for limiting a penetration of volatile media from the first space into the second space.

67[)]. (Amended) [Device] A device according to claim 66, [characterized in that the] further comprising a plurality of first valves [of said device for producing polarized media comprise] for coupling the assembly, the compressor, and the storage volume, wherein individual ones of the plurality of first valves include an ultra high vacuum (UHV) compatible lead through [according to claim 53] .

68[)]. (Amended) [Device] A device according to claim 67, [characterized in that several] wherein individual ones of the plurality of first valves [of said device for producing polarized media] are gathered into valve [blocs] blocks.

69[)]. (Amended) [Device] A device according to claim 68, [characterized in that said] wherein the valve [blocs] blocks further comprise [an] intermediate [vacuum] vacua common for a number of first valves, and [that] wherein the intermediate vacua are connected to each other via bores.

70[)]. (Amended) [Device] A device according to claim 69, [characterized in that one or several of said] wherein at least one of the valve [blocs] blocks comprise at least one of [the] an inlet valve from [said] the optical pumping assembly to [said] the compressor assembly [and /] or [the] an outlet valve from [said] the compressor assembly into [said] the storage volume.

71[)]. (Amended) [Device] A device according to claim 69, [characterized in that one or several of said] wherein at least one of the valve [blocs] blocks comprise [the] at least one second valve[s] for at least one of evacuating [said] the optical pumping assembly [and / or for] , controlling [the gas] flows of the polarized medium, [and] or controlling [the] pressure monitors.

72[)]. (Amended) [Device] A device according to claim 67, further comprising [characterized in that the] a pipeline system [of the device] for [gas] transport of the polarized medium and evacuation connected to the assembly, the compressor, and the storage volume, including [comprises] little outgassing aluminum tubes, [tightend] fastened by [metal] rings.

73[)]. (Amended) [Device] A device according to claim 67, [characterized in that said device comprises] further comprising a getter that is selectively absorbing positioned in a flow ahead or after [said] the optical pumping assembly [(seen in the direction of flow) selectively absorbing getters].

74[)]. (Amended) [Device] A device according to claim 73, [characterized in that said] wherein the getters comprise nonferromagnetic getter substances.

75[)]. (Amended) [Device] A device according to claim 73, [characterized in that said] wherein the getters are evaporation getters.

76[)]. (Amended) [Device] A device according to claim 74, [characterized in that said] wherein the nonferromagnetic getter substances comprise little relaxing titanium.

77[)]. (Amended) [Device] A device according to claim [75] 74, [characterized in that said] wherein the nonferromagnetic getter substances comprise [Bismuth] bismuth.

78[)]. (Amended) [Device] A device according to claim 75, [characterized in that said] wherein the optical pumping assembly comprises [itself one or several of said] at least one evaporation getter[s].

79[)]. (Amended) [Device] A device according to claim 78, [characterized in that said] wherein the at least one evaporation getter is part of [said] the optical pumping assembly and is operated as a cathode in [the] a plasma region of [said] the optical pumping assembly in order to selectively bind [other] gases other than the polarized medium [fast and selectively].

80[)]. (Amended) [Device] A device according to claim 75, [characterized in that said] wherein the evaporation getters comprise cooling set-ups.

81[)]. (Amended) [Device] A device according to [one of the] claim [67] 72, [characterized in that said device is designed such that the] further comprising a dead volume within each of

[said] a cylinder head of the compressor[,] ;

[said outlet valve of said] at least one of the plurality of first valves coupling the compressor assembly to [said] the storage volume; and

[said pipelines] a portion of the pipeline system connected to [said] the storage volume,

wherein each of the dead volumes are [being] minimized in order to enable a fast and [almost] substantially complete [gas] polarized medium transport from [said] the compressor assembly to [said] the storage volume.

82[)]. (Amended) [Device] A device according to claim 81, [characterized in that the stroke volume of said] wherein the compressor comprises a stroke volume such that [is designed in such a way that the] a fraction of [the] gas [which remains] remaining and relaxing in the dead volume [and relaxes therein] is [being] minimized.

83[)]. (Amended) [Device] A device according to claim 67, [characterized in that said] wherein the compressor assembly comprises a compressor cylinder, and [that the] wherein a ratio of [the] a circumference of the [said] compressor cylinder to [the] a stroke volume of [said] the compressor assembly is smaller than about $1/(30cm^2)$[, preferably smaller than $1/(100cm^2)$, and most preferably smaller than $1/(300\ cm^2)$].

84[)]. (Amended) [Device] A device according to claim[s] 67, [characterized in that said] wherein the optical pumping [set-up] assembly comprises at least one long cell containing the optically pumped low pressure plasma.

85[)]. (Amended) [Device] A device according to claim 84, [characterized in that said] the long cell comprises mirrors [which] that serve to double [the] an absorption path length of [the] pumping light within [said] the long cell, thereby conserving [the] a degree of circular polarization.

86[)]. (Amended) [Device] A device according to claim 85, [characterized in said] wherein the mirrors are [designed as being] transparent for certain spectral lines of ^{3}He.

87[)]. (Amended) [Device] A device according to claim 67, [characterized in that the light source of said] wherein the optical pumping assembly [features] has a light source that has a spectral distribution [which] that is adapted to [the] a Doppler-width of [the] an absorption line of [the] a noble gas.

88[)]. (Amended) [Device] A device according to claim 87, [characterized in that said] wherein the light source is a laser light source and [that] for a given laser power the cross section of [the] a laser beam emitted from said laser light source is [designed in such a manner] formed such that [the] a resulting light intensity will not surpass [the] a saturation value of a maximum optical pumping rate.

89[)]. (Amended) [Device] A device according to claim 84, [characterized in that said] wherein the optical pumping assembly comprises imaging optical elements [being] arranged outside [said optical pumping cells] the at least one long cell in order to focus [the] a beam from [the] a light source of the optical pumping assembly such that [the] a cross section of [said] the beam remains [everywhere] smaller than [the] a cross section of the at least one long cell in order to prevent [for instance] depolarizing reflection from [the cell] walls of the at least one long cell.

90 [)]. (Amended) [Device] A device according to claim 84, [characterized in that] wherein at least [the] an entrance window and [the] an outlet window[s] of [said low pressure] the at least one long cell[s are made of] include glass of optical quality.

91[)]. (Amended) [Device] A device according to claim 90, [characterized in that] comprising an element for determining [the] a degree of circular polarization of light, [is provided and that said]

wherein the degree of circular polarization is determined by taking [the] a difference of a maximum and a minimum measured voltage value and dividing it by their sum,

wherein these [measurements being performed] voltage values are obtained by passing the light first through a λ/4 retardation plate followed by a liquid crystal element and finally a linear polarizer [before it] after which the light generates in a photo detector a first voltage value, and

wherein the first voltage value is the maximum or the minimum measured value [one or the other of said voltage values] depending on a positive or negative voltage signal applied to the liquid crystal element which reacts [on said positive or negative voltage signal] by forming a bi-refringent optical delay plate [featuring] having delays of either an even or an odd multiple of half of [the] a wave length λ/2 or vice versa.

92[)]. (Amended) [Device] A device according to claim [87] 91, [characterized in that said] wherein the element for determining the degree of circular polarization [is being used to determine the] determines a degree of nuclear polarization of [said] a noble gas plasma.

93[)]. (Amended) [Device] A device according to claim 66, [characterized in that said] wherein the optical pumping [set-up] assembly comprises at least one high frequency driven electrode powering the low pressure plasma.

94[)]. (Amended) [Device] A device according to [one of the] claim [66] 69, [characterized in that said device comprises] wherein the intermediate vacua [at least one] are connected to the optical pumping assembly [to which said

intermediate vacua of said elements with moveable components are being connected].

95[)]. (Amended) [Device] A device according to claim 94, [characterized in that said device comprises] further comprising a purification assembly for purifying [the] a gas pumped out of [said] the intermediate vacua [with the possibility to recycle that] , and wherein the purified gas is recycled within [said] the device.

96[)]. (Amended) [Procedure] A procedure for producing nuclear spin polarized gasses comprising [the following steps]:

[Optical] optically pumping a gas in a low pressure plasma to produce a polarized gas;

[followed by mechanical compression of] mechanically compressing the polarized gas using a fractional pumping method; and

[transport] transporting the gas into a storage volume[,

wherein the method of fractional pumping is being applied in the compression process].

97[)]. (Amended) [Procedure] A procedure according to claim 96, [characterized in that said] wherein the fractional pumping method is performed by an ultra high vacuum (UHV) compatible lead through [according to claim 53] including:

a housing;

a first space within the housing and connected via a first port to a space outside the UHV-compatible lead through;

a second space within the housing and connected via a second port to a closed system containing the polarized gas;

a movable component separating the first space from the second space via an intermediate space; and

a seal for limiting a penetration of volatile media from the first space into the second space.

98[)]. (Amended) [Procedure] A procedure according to claim 96, [characterized in that] wherein the production of the nuclear spin polarized gases is performed [by help of a device according to claim 66] using a device comprising:

an assembly for optical pumping gasses in a low pressure plasma to produce polarized gasses;

a compressor assembly for compressing the polarized gases; and

a storage volume for storing the polarized gasses,

wherein the compressor assembly comprises at least one ultra high vacuum (UHV) compatible lead through, including:

a housing;

a first space within the housing and connected via a first port to a space outside the UHV-compatible lead through;

a second space within the housing and connected via a second port to the device;

a movable component separating the first space from the second space via an intermediate space; and

a seal for limiting a penetration of volatile media from the first space into the second space.

99[)]. (Amended) [Procedure] A procedure according to claim [96, characterized in that said] 97, further comprising actively pumping the intermediate space [vacua are pumped actively].

100[)]. (Amended) [Procedure] A procedure according to claim 96, [characterized in that] wherein the gas [will be] is purified [from] of contaminants by getter devices before and/or during at least one of optical pumping [and/]or compression.

101[)]. (Amended) [Procedure] A procedure according to claim 100, [characterized in that said] wherein the getter devices are [being] cooled.

102[)]. (Amended) [Procedure] A procedure according to claim 101, [characterized in that said] wherein the getter devices are cooled [down] to [the] a temperature of liquid nitrogen.

103[)]. (Amended) [Procedure] A procedure according to claim 96 [characterized in that the compression] , wherein mechanically compressing is performed by a single compressor up to a pressure [smaller] of less than 10 bar [is performed with one and the same compressor device].

104[)]. (Amended) [Procedure] A procedure according to claim 96 [characterized in that the] , wherein the fractional pumping method yields noble gas [which is being pumped out of the actively pumped vacua is being purified and recycled to the device for producing] and the procedure includes:

purifying and recycling the noble gas; and

producing polarized noble gas[es].

Please add the following new claims:

105. (Newly added) An ultra high vacuum compatible lead through according to claim 53, wherein the moveable component within the housing is a first tappet rod.

106. (Newly added) An ultra high vacuum compatible lead through according to claim 105, wherein the first tappet rod is a tappet rod of a piston.

107. (Newly added) An ultra high vacuum compatible lead through according to claim 105, wherein the first tappet rod is a tappet rod of a valve.

108. (Newly added) An ultra high vacuum compatible lead through according to claim 105, wherein the intermediate space has a sufficient extension such that a stroke of the first tappet rod is always shorter than the extension of the intermediate space in a direction of movement of the first tappet rod.

109. (Newly added) An ultra high vacuum compatible lead through according to claim 105, wherein the intermediate space is sealed by gaskets fixed in notches around the first tappet rod.

110. (Newly added) An ultra high vacuum compatible lead through according to claim 53, wherein the intermediate space is sealed by gaskets fixed in notches around a cylinder surrounding the intermediate space.

111. (Newly added) An ultra high vacuum compatible lead through according to claim 105, wherein the first tappet rod is driven by a hydraulic gear.

112. (Newly added) A device according to claim 67, wherein the compressor assembly comprises a compressor cylinder, and wherein a ratio of a circumference of the compressor cylinder to a stroke volume of the compressor assembly is smaller than about $1/(100cm^2)$.

113. (Newly added) A device according to claim 67, wherein the compressor assembly comprises a compressor cylinder, and wherein a ratio of a circumference of the compressor cylinder to a stroke volume of the compressor assembly is smaller than about $1/(300\ cm^2)$.